

Linewidth Analyzer  
LWA-1k 1550



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The Standard of Accuracy

Wavelength Range	min.	typ.	max.
1530 – 1625 nm	1530 nm	1550 nm	1625 nm

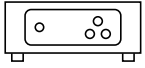
  

Required Input Power <sup>1)</sup>	min.	typ.	max.
0.5 – 8 mW	0.5 mW	5 mW	8 mW

Input Power Stability
± 5 %

1) Best performance with typical input power. Noise sensitivity scales inversely with input power.



## Analyzer Unit

Laser type CW and single-mode

Input type PM-FC/APC

## Spectral and Frequency Noise Specifications

		10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	> 1 Mhz
Noise floor $N_{\Delta\nu}$ @ typ. input power and wavelength <sup>2)</sup>	Hz/ $\sqrt{\text{Hz}}$	80	40	15	10	8	5
Laser phase noise floor @typ. input power and wavelength <sup>3) 4)</sup>	rad/ $\sqrt{\text{Hz}}$	8	400m	15 m	1 m	80 $\mu$	5 $\mu$
	dBrad/ $\sqrt{\text{Hz}}$	18	-8	-36	-60	-82	-106
Equivalent interferometer signal noise @ typ. input power and wavelength <sup>4) 5)</sup>	rad/ $\sqrt{\text{Hz/m}}$	2.5 $\mu$	1.3 $\mu$	460 n	310 n	250 n	160 n
	dBrad/ $\sqrt{\text{Hz/m}}$	-112	-118	-126	-130	-132	-136
Frequency noise bandwidth <sup>6)</sup>		10 Hz – 10 MHz					
Frequency noise sensitivity		< 10 Hz/ $\sqrt{\text{Hz}}$ – 10 MHz/ $\sqrt{\text{Hz}}$					
Intrinsic linewidth range <sup>7)</sup>		< 100 Hz					
Effective linewidth <sup>8)</sup> range ( $\beta$ -separation)		< 1 kHz – 20 MHz					
Relative intensity noise limit		-150 dB/Hz					

2)  $N_{\Delta\nu}$  is the noise floor of the instrument in terms of the square root of the power spectral density of the frequency noise.

3) The phase noise floor corresponds to the noise floor of the square root of the power spectral density of the phase. It is calculated from  $N_{\Delta\nu}$  by the formula  $1/f \times N_{\Delta\nu}$ . Additionally, phase noise is often specified in terms of  $\mathcal{L}(f)$  which can be calculated with the formula  $\mathcal{L}(f) = 1/f^2 \times N_{\Delta\nu}^2/2$ .

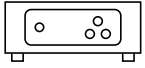
4) Not included in the software, can be calculated by the user from exported data.

5) This is the calculated noise of the interferometer phase of a two path interferometer with length imbalance  $L$  (in meters). The calculation is performed for a given frequency noise density floor by  $2\pi nL/c \times N_{\Delta\nu}$  with  $n$  being the refractive index of the reference fiber interferometer material and  $c$  being the speed of light in vacuum. Values in the table are given for a refractive index of  $n=1.46$  and a reference length of 1 meter.

6) According to a -3 dB criterion.

7) Intrinsic linewidth: Limited by fundamental quantum processes and laser design. Determined by the noise floor (white noise) of the frequency noise spectrum and calculated by: noise density (in Hz<sup>2</sup>/Hz) times  $\pi$  (rule of thumb). This value is most commonly denoted as “laser linewidth” by laser manufacturer.

8) Effective linewidth: Combination of intrinsic linewidth and additional broadening mechanisms (thermal, electronical and acoustic noise). Determination by  $\beta$ -separation method (noise density spectrum) or curvefitting procedure (lineshape spectrum).



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## Analyzer Unit

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### Lineshape Specifications

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Effective linewidth <sup>6)</sup> range (FWHM)	< 1 kHz – 10 MHz
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Dynamic range	60 dB
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### Miscellaneous

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Interface	2 × USB 3.0
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Analog Output / error signal <sup>9)</sup>	BNC $\pm 7.5$ (50 $\Omega$ ) $\pm 15$ (high impedance) V, single ended
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Cutoff (highpass filter)	10 Hz, 1 kHz, 10 kHz, 100 kHz
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Dimensions	220 mm × 334 mm × 96 mm
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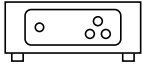
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Weight	8 kg
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6) According to a -3 dB criterion.

9) Linewidth reduction/control: Analog output as error signal for use in combination with PID controller (not included) for frequency noise or RIN reduction.



# Linewidth Analyzer LWA-1k 1550



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## Digitizer Unit

Sample rate	62.5 (max.) MSa/s
Resolution	16 bits
Acquisition time	1 – 100 ms
Evaluation time	< 1 (typ.) s

## Miscellaneous

Communication	USB 3.0 type B
Dimensions	210 mm × 200 mm × 74 mm
Weight	2 kg

## Software

Operating system	Microsoft® Windows® 10 or newer
CPU (recommended)	Intel® i5 8600 / AMD Ryzen™ 5 2600 or better
Memory (recommended)	16 GB RAM or more
Graphical evaluation options	Frequency noise density spectrum, lineshape spectrum, intrinsic (Lorentzian) linewidth, effective (optical) linewidth

## Further Information

For further technical information, application examples, diagrams and for customisation of linewidth analyzers please contact:

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